

CLAIMS

1. A method for joining a first tube to a member comprising the steps of:
  - a) obtaining a first tube having a flange;
  - 5       b) obtaining a member;
  - c) after steps a) and b), disposing the first tube and the member with the flange contacting the member either directly or indirectly through an intervening joining material; and
  - 10       d) after step c), locally heating the first tube and/or the member proximate the contact of the flange and the member without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the member.
- 15       2. The method of claim 1, wherein the flange is an annular outwardly-extending end flange disposed proximate an end of the first tube.
3. The method of claim 2, wherein the end flange is a non-folded end flange.
4. The method of claim 2, wherein the end flange is a folded end flange.
- 20       5. The method of claim 1, wherein the member is a second tube.
6. The method of claim 5, wherein the second tube has an annular outwardly-extending non-folded end flange, and wherein step c) disposes the first tube and the second tube with the flange of the first tube contacting the end flange of the  
25       second tube either directly or indirectly through an intervening joining material.
7. The method of claim 1, wherein the second member is a non-tubular member.

8. The method of claim 2, wherein the second member is a non-tubular member having a through hole, and wherein step c) coaxially aligns the first tube with the through hole of the non-tubular member with the flange of the first tube contacting the non-tubular member either directly or indirectly through an  
5 intervening joining material.
9. The method of claim 1, also including, before step c), the step of disposing a curable adhesive joining material on the flange and/or the member at the contact of the flange and the member, and wherein step d) includes locally resistance  
10 heating the first tube and/or the member proximate the contact of the flange and the member curing the adhesive joining material without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the member.
- 15 10. The method of claim 9, also including, during step d), the step of applying a force to urge the flange against the member.
11. The method of claim 1, wherein step d) includes laser-beam welding the first tube and/or the member proximate the contact of the flange and the  
20 member without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the member.
12. The method of claim 11, wherein the flange is a folded flange having spaced-apart first and second fold portions, and also including, during step d),  
25 the step of applying a force to relatively move the folded flange deformingly against the member.
13. The method of claim 1, wherein step d) includes electron-beam welding the first tube and/or the member proximate the contact of the flange and the  
30 member without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the member.

14. The method of claim 13, wherein the flange is a folded flange having spaced-apart first and second fold portions, and also including, during step d), the step of applying a force to relatively move the folded flange deformingly  
5 against the member.

15. The method of claim 1, wherein step d) includes creating a resistance welding current path through the first tube and the member proximate the contact of the flange and the member without substantially heating the first tube  
10 and/or the member apart from proximate the contact of the flange and the member creating a weld zone which includes at least some of the flange and at least some of the member.

16. The method of claim 16, wherein the flange is a folded flange having spaced-apart first and second fold portions, and also including, during step d),  
15 the step of applying a force to relatively move the folded flange deformingly against the member.

17. The method of claim 1, also including, before step c), the step of disposing  
20 a brazing joining material on the flange and/or the member at the contact of the flange and the member, and wherein step d) includes creating a resistance brazing current path through the first tube and the member proximate the contact of the flange and the member without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the  
25 member creating a braze zone which includes at least some of the flange and at least some of the member.

18. The method of claim 17, wherein the flange is a folded flange having spaced-apart first and second fold portions, and also including, during step d),  
30 the step of applying a force to relatively move the folded flange deformingly against the member.

19. A method for joining a first tube to a second tube comprising the steps of:
- a) obtaining a first tube having an outwardly-extending folded end flange disposed proximate an end of the first tube;
  - 5       b) obtaining a second tube having an outwardly-extending non-folded end flange disposed proximate an end of the second tube;
  - c) disposing a curable adhesive joining material on the folded end flange and/or the non-folded end flange;
  - d) after steps a) through c), disposing the first tube and the second tube
  - 10       with the end of the first tube disposed within the second tube, and with the curable adhesive joining material disposed between and directly contacting the folded end flange and the non-folded end flange; and
  - e) after step d), locally resistance heating the first tube and/or the member proximate the contact of the flange and the member curing the adhesive
  - 15       joining material without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the member.
20. A method for joining a first tube to a member comprising the steps of:
- a) obtaining a first tube having a flange;
  - 20       b) obtaining a member;
  - c) after steps a) and b), disposing the first tube and the member with the flange contacting the member either directly or indirectly through an intervening joining material; and
  - d) after step c), welding/brazing the first tube and/or the member
  - 25       proximate the contact of the flange and the member without substantially heating the first tube and/or the member apart from proximate the contact of the flange and the member.